REMARKS

The Applicants request reconsideration of the rejection.

Claims 3-4, 11-14, and 16-17 will be pending upon entry of the above amendments.

Claim 15 has been canceled, without prejudice, to avoid the objection and rejection asserting new matter under 35 U.S.C. §132.

Claims 3-4 and 11-17 were rejected under 35 U.S.C. §103(a) as being unpatentable over EP 0 885 648 (EP '648) in view of either JP 11-216,455 (JP '455) or Lang, et al., US 6,235,256 (Lang). The Applicants traverse as follows.

In the present invention as now claimed, a mist is removed by a mist removal means (for example, the cyclone type mist separator shown in Fig. 2 or the filter-type mist separator in Fig. 3). The mist thus removed is drained in a form of a liquid of a gather of mists through the liquid waste outlet 24 shown in Fig. 2, or through a liquid waste outlet provided in the exhaust gas washing tower 13 side shown in Fig. 3 (this outlet is not illustrated for simplicity), in the illustrated embodiments.

However, this process does not always provide a perfect removal of mists. The residual mists not removed by the mist removal means cohere on the internal structure of the casing

of the mist separator in the room in the rear stage of the mist removal means therein to form a liquid of a gather of mists. This further develops into a standing liquid in the upper room of the inner cylinder 26 as shown in Fig. 2, or in the upper room of the filter 33 as shown in Fig. 3. This standing liquid is discharged through the liquid waste outlet provided at the rear stage of the moisture removal means (for example, the liquid waste outlet 25 in Fig. 2, or the liquid waste outlet 36 in Fig. 3). Thus, the residual mist still accompanying the mist-removed gas can be removed at a higher yield.

It is therefore evident that this higher-yield removal of mist considerably reduces corrosion of the exhaust pipe and the exhaust blower, and minimizes the atmospheric emission of substances such as HF, SO_3, and NO, with reduced affect to the environment.

The mist removal means defined in the present claims after amendment is supported by the description for Embodiments 1 and 2 in the present specification. Each of the liquid waste outlets in the present invention after amendment is also supported by the description as stated above.

The present invention particularly relates to a decomposition treatment of PFC gases, notably at least one of

SF_6 and NF_3. Since the decomposition treatment of SF_6 and NF_3 produces decomposition products such as HF, SO_x (mainly SO_3), and NO_x (mainly NO and NO_2), the exhaust of decomposition products would be emitted into the atmosphere after washing treatment in a washing tower in which such decomposition products are absorbed in water or alkaline aqueous solution.

As the present specification describes, however, the inventor has found a new problem that the washing with water or alkaline aqueous solution causes a part of HF, SO_3, and NO in the decomposition products to form a mist accompanied with H_2O, and such mist may clear the washing tower. For example, approximately 250-mol of H_2O accompanies 1-mol of SO_3 to form the mist, which is exhausted into the exhaust line in the decomposition system. This new problem has led the inventor to the present invention.

More specifically, the newly found problems are that SO_3 condenses when the temperature of the exhaust gas becomes below its dew point, adhering on the inner wall of the exhaust pipe to cause choking thereof, the SO_3 condensation also occurs on the exhaust blower, adhering inside thereof to make the blower malfunction; NO generated from the decomposition treatment of NF_3 produces nitric acid mist, which flows into the exhaust line to corrode the exhaust pipe; and HF generated

from the decomposition treatment of carbon-based PFC gas also corrodes the exhaust pipe or blower.

In addition to the above, mists are further removed at the rear stage of the mist removal means to discharge through the liquid waste outlet in a form of liquid of a gather of mists as mentioned above. It is therefore evident that the removal of mist, as claimed, considerably reduces corrosion of the exhaust pipe and the exhaust blower, and minimizes the atmospheric emission of those substances such as HF, SO_3, and NO.

Turning to the applied references, EP '648 is directed to a treatment method in which, after decomposing SF_6 and NF_3 with water or an alkaline aqueous solution, an exhaust gas cleaning tank is used for washing the exhaust gas. However, EP '648 neither discloses nor suggests the need for or implications of removal of washing-caused mists after the washing process. That is, EP '648 does not teach the claimed steps of (for example) removing decomposition products from the gas washed in the washing step, wherein a waste including a mist remains after the removing of the decomposition products; removing the mist from the waste remaining after the washing, thereby removing PFC decomposition products accompanied with the mist, wherein a gas remains after the removal of the mist from the

waste; and exhausting the gas from which the mist has been removed in the step of removing the mist from the waste, wherein the step of removing mist is performed to remove at least one of SO_x and NO_x accompanying water, which are decomposition products of the SF_6 and/or NF_3 from the washed gas.

The cited invention further describes that the decomposing of SF_6 and NF_3 is performed at a lower temperature with increased efficiency, and that the working life of the decomposition catalyst used in an associated decomposition processing unit are lengthened thereby. This description, however, shows the different focus and objective of EP '648, and does not suggest the removal of a mist as claimed. Therefore, the present invention is different from EP '648 in composition, objective, and effect.

Furthermore, whereas EP '648 discloses techniques for removing HF and other toxic products, EP '648 does not appear to note that some decomposition products survive the washing step and in fact pass the washing tower in a form of mist accompanied by H_2O, or that the passed mist is emitted atmospherically. EP '648 also does not appear to note that HF, SO_3, and NO may be removed from the passed mist before atmospheric emission.

In this regard, the passage noted by the Examiner (the paragraph bridging pages 3 and 4 of EP '648) relates to a scrubbing to remove sulfur oxides and nitrogen oxides in parallel with the washing to remove decomposition products such as HF. Thus, the passage does not meet the claimed removal step, which is performed after the washing (i.e., on the results of the washing).

The Applicants have, however, noted page 4, lines 29-31 of EP '648, which describe an adsorbent for adsorbing carbon monoxide, sulfur oxide, and nitrogen oxide, which have not been absorbed by alkaline scrubbing, at a rear step of the exhaust gas scrubber. However, the amended claims require removal of mist containing the offensive products prior to exhausting the gas to atmosphere, using a mist removal means (for example, a cyclone), such that the removed mist is then drained through a liquid waste outlet in a form of liquid of a gather of mists, and residual mists not removed by the mist removal means are discharged in a form of liquid of a gather of residual mists through a liquid waste outlet provided at a rear stage of the mist removal means installed in the emission side of the gas exhausted in the exhausting step. Such a mist removal means is distinct from the disclosure of an adsorbent.

In summary, EP '648 neither discloses nor suggests the removal of mists from the gas washed at the washing tower. This means that the structure and method disclosed in EP '648 will encounter many particulars such that the washed exhaust gas still includes much mist; such mists contain SO_3 and NO; the SO_3 condenses on the inside wall of the exhaust pipe when the exhaust gas cools down below its dew point, causing choking of the exhaust pipe; condensation also occurs inside the exhaust blower, causing the blower to be inoperable; NO, which is produced in decomposing NF_3, will generate mists of nitric acid; and the nitric acid flows into the exhaust line, causing corrosion of the exhaust pipes.

In contrast to this, the present invention removes mists from the washed exhaust gas twice. Thus, corrosion of the exhaust pipe and the exhaust blower are considerably reduced; and atmospheric emission of HF, SO_3, and NO, which are decomposition products, is minimized, with reduced affect to the environment.

The secondary reference, JP '455, shows a process of rendering a waste gas harmless before emitting it into the atmosphere, wherein the waste gas, which is generated in treatment of discarded printed circuit boards and includes hydrogen bromide, carbon dioxide, and steam, is washed with an

aqueous solution of NaOH and then is dehydrated by a cyclone to be dried for emission. In its description, JP '455 says that the washed waste gas contains moisture only; inclusion of hydrogen bromide and carbon dioxide is not mentioned.

The cited reference, however, does not mention that NF_3 or SF_6 is decomposition-treated; but also that the washing of the gas, which includes decomposition products generated from the decomposition treatment, with water or alkaline aqueous solution, causes a part of HF, SO_3, and NO included in the decomposition products to form a mist accompanied with H_2O, and that such mist is emitted into the atmosphere clearing the washing tower. Further, there is no description at all about the removal of HF, SO_3, and NO before exhausting into the atmosphere, as required by the claims. Thus, neither EP '648 nor JP '455 discloses this feature of the invention, and it necessarily follows that their combination cannot meet the claims.

In this regard, the argument is noted that removal of products in the mist would be "inherent" in the mist removal itself. However, the Applicants respectfully submit that the person of ordinary skill is well taught by EP '648 just what products are to be removed and how removal is to be accomplished (as outlined above), such that there is simply no

motivation to add a mist removal step as taught by JP '455. Put simply, EP '648 accepts the exhaustion of mere moisture; it is the unrecognized products in the mist which must be recognized in order to be motivated to remove them. EP '648 thus essentially teaches away from any mist removal which might be suggested by JP '455, and JP '455 does not provide the motivation to overcome the essential teaching away.

Moreover, JP '455 does not describe any concrete feature about a mist removal means as now claimed. Water removed by a cyclone-dependent mist removal means is drainable. However, the exhaust gas that passes such a mist removal means still contains some amount of mists. It is therefore evident that this mists left over in the passed-through gas will cohere to form a liquid of a gather of mists in the vicinity of the mist removal means, causing corrosion thereof, and of the exhaust pipe and the exhaust blower as well.

Thus, the present invention differs from the art defined in JP '455 in composition, objective, and effect, such that no motivated combination with EP '648 could lead a person ordinarily skilled in the art to the present invention.

Similarly, the secondary reference to Lang describes a process of water washing for acidic gasses such as SO_2, HCl, and H_2S in a scrubbing tower 1 having a demister of a first

stage 3 and a second stage 4 to remove acidic gas components. However, Lang does not mention at all such aspects that NF_3 or SF_6 is decomposition-treated; that the washing of the gas, which includes decomposition products generated from the decomposition treatment, with water or alkaline aqueous solution causes a part of HF, SO_3, and NO included in the decomposition product to form mist accompanied with H_2O; and that such mist is emitted into the atmosphere clearing the washing tower. Further, there is no description at all about the removal of HF, SO_3, and NO before exhausting into the atmosphere.

As stated above, a part of HF, SO_3, or NO in the decomposition products clears the washing tower in a form of mist accompanied with H_2O; SO_3 condenses, adhering on the inner wall of the exhaust pipe to cause choking thereof, and adhering inside the exhaust blower to make the blower malfunction; NO corrodes the exhaust pipe, etc.; and HF also corrodes the exhaust pipe or the exhaust blower. However, Lang neither describes nor suggests these points.

Instead, Lang describes that an accompanied mist is removed by colliding an acidic exhaust gas 17 against walls 10 and 10', and that un-removed remaining acidic components are removed by spraying H_2O onto a demister 4. These steps

correspond to the steps proceeding up to the exhaust gas washing tower in the present invention. It is evident in the cited reference that mist that includes the acidic exhaust gas 17 flows as it is from the duct into the exhaust gas flow 17" at the last stage as shown in Fig. 1. This means that there is neither description nor suggestion of collection of mist itself in order to remove SOx and NOx. Accordingly, there is no motivation to demist EP '648 according to Lang for the same reasons one of ordinary skill would not modify EP '648 according to JP '455, and any motivated combination of the two teachings would not reach the claimed invention.

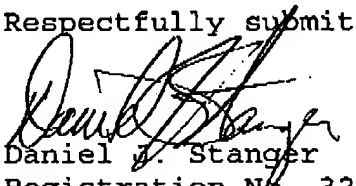
Moreover, Lang provides neither description nor suggestion of such features defined in the present claims, that mists are removed by the mist removal means from the washed exhaust gas, then are drained through the liquid waste outlet in a form of liquid of a gather of mists; and that residual mists not removed by the mist removal means are discharged in a form of liquid of a gather of residual mists through the liquid waste outlet provided at the rear stage of said mist removal means installed in the gas emission side. Therefore, it is evident in the present invention that mists are collected in an assured manner, and thereby corrosion of

the exhaust pipe and the exhaust blower is considerably reduced.

Thus, the present invention differs from the art defined in Lang in composition, objective, and effect, such that no motivated combination with EP '648 could lead a person ordinarily skilled in the art to the present invention.

In view of the foregoing amendments and remarks, the Applicants request reconsideration of the rejection and allowance of the claims.

Respectfully submitted,



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Date: June 23, 2005